

What is Thermal Runaway?

Identifying the problem to develop solutions

Underwriters Laboratories is at the forefront of electrochemical safety science. At a time when potentially risky energy storage technologies can be found in everything from consumer products to transportation and grid storage, Underwriters Laboratories helps to lay the groundwork for energy storage designs that are reliable and safe.

Problem

One of the primary risks related to lithium-ion batteries is thermal runaway. Thermal runaway is a phenomenon in which the lithium-ion cell enters an uncontrollable, self-heating state. Thermal runaway can result in cell venting, fire, smoke and temperatures above 1000 degrees centigrade.

Background

In lithium-ion cells, the movement of lithium ions produces electricity. The process of charge and discharge is normally accompanied by a small amount of heat. In ideal conditions, the heat is able to dissipate from the cell.

In thermal runaway, the lithium-ion cell generates heat at a rate several times higher than the rate at which heat dissipates from the cell.

The cell reaches thermal runaway when its temperature rises uncontrollably at a rate greater than 20° centigrade per minute with maximum temperatures reaching greater than 300°C accompanied by gas and/or electrolyte venting, smoke or fire or a combination of all.

Thermal runaway can be the result of faults in the lithium-ion cell caused by either internal failure or external conditions.

Where are lithium-ion batteries?

Lithium-ion batteries empower us to be flexible with energy storage. They make it easier to use on-the-go energy in portable products. They also enable us to store more energy from renewable sources, including wind and solar power.

Examples of devices that use lithium-ion batteries include:

- Mobile phones
- Electric vehicles
- Drones
- Public transit
- Headphones
- Hoverboards
- Solar panels
- Power banks
- Satellites
- Laptops
- Wearable tech
- Medical devices

